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(54) **HORIZONTAL FLOW BIOFILTER SYSTEM AND METHOD OF USE THEREOF**

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This patent is subject to a terminal disclaimer.

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See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,225,434 A 9/1980 Ernst et al.
4,833,083 A 5/1989 Saxena et al.
(Continued)

FOREIGN PATENT DOCUMENTS

JP 62-140697 A 6/1987
JP 05-132993 5/1993
(Continued)

OTHER PUBLICATIONS

International Search Report/ Written Opinion issued in PCT/US2007/088635 on Apr. 21, 2008, 8 pages.

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(57) **ABSTRACT**

A horizontal flow water treatment method and wetland biofilter apparatus provides a chamber with impermeable outer walls spaced away from permeable interior walls of a media filtration bed such that a catch basin is formed between the outer walls and the interior walls. The catch basin creates an open area around the perimeter of the interior walls for influent water to fill within the open area before penetrating the filtration media, providing a large surface area for influent water to interact with the media filtration bed. The influent water enters the catch basin in a horizontal flow path to provide for pre-settling of particulates before making contact with the filtration media. The biofilter design increases the available surface area of the media filtration bed by up to four times for a given volume of water, and thereby minimizes the loading or infiltration rate on the media filtration bed.

25 Claims, 19 Drawing Sheets